

Please amend the paragraph on Page 2, lines 1 - 8, to read as follows:

A2
Those optical devices are mainly realized using silica optical waveguides. In an optical transmission system of an intermediate or longer haul, a single mode silica optical fiber which is capable of transmitting optical signals at low loss is used as a transmission line. It is for this reason that both the silica optical waveguide and the silica optical fiber are made of the same quartz materials and therefore can be optically coupled at low loss by direct connection.

Please amend the paragraph from Page 3, line 17, to Page 4, line 10, to read as follows:

A3
As stated above, a MFD of a silica optical waveguide with a larger relative refractive index difference (is as small as $5\ \mu\text{m}$ and accordingly the coupling loss with a silica optical fiber becomes larger. To solve the above reciprocal relation between the curve loss and the coupling loss, a method has been proposed that reduces the refractive index of a core of a silica waveguide in the coupling part with an optical fiber and at the same time enlarges a core diameter. This method is called a thermally expanded core (TEC) method. In essence, after connecting a silica optical waveguide and a silica optical fiber, a core of the silica optical waveguide near to the connecting part is locally heated with an ultraviolet laser or the like to diffuse the elements doped to the core of the silica optical waveguide. Accordingly, in the area near to the connecting part of the silica optical waveguide, the refractive index of the core reduces and the core diameter enlarges causing the increase of the MFD and the decrease of the coupling loss.

Please amend the paragraph from Page 4, line 23, to Page 5, line 8, to read as follows:

A4
In a conventional system to extend a core width, it is possible to perform a batch forming through patterning of the core. However, the silica optical waveguide becomes a multi mode waveguide in the connecting part, namely the part in which the core diameter is extended and therefore it is unavoidable that a high-order lateral mode generates. The optical signals converted to the high-order mode either cannot or minimally couple with the single mode silica optical fiber and accordingly the coupling efficiency of those optical signals decreases.

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cont.
Please amend the paragraph on Page 5, lines 11 - 13, to read as follows: 7

It is therefore an object of the present invention to provide an optical connecting structure capable of forming a plurality of connecting parts in one operation and realizing a high coupling efficiency.

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Please amend the paragraph on Page 6, lines 12 - 20, to read as follows:

The above configurations make it possible to optically couple the plane optical waveguide and the optical fiber at a high efficiency. It is sufficient as far as at least one of the width and depth of the core is tapered as it approaches to the optical fiber, and therefore it is relatively easy to form the structure. It is especially easy to taper the width of the core as it approaches to the optical fiber. In addition, this structure reduces costs because even if a large number of optical coupling parts are required, it is possible to perform all the tapering in one operation.

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Please amend the paragraph on Page 7, lines 2 - 8, to read as follows:

Even if the relative refractive index difference (between the core and clad is larger than that of the optical fiber, the taper configuration functions to approximate both propagation constants so that the optical coupling is performed easier. Consequently, it enables the use of plane optical waveguides having a high Δ and the ability to make the optical devices utilizing such waveguides more compact.

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Please amend the paragraph on Page 7, lines 15 - 16, to read as follows:

FIG. 1 shows a perspective view of the main elements of an embodiment according to the invention;

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Please amend the paragraph on Page 9, lines 5 - 14, to read as follows:

The core 12 of the silica waveguide 10 and the core 22 of the silica optical fiber 20 meet at the side of the silica optical waveguide 10. In this embodiment, the width of the core 12 of the silica optical waveguide 10 tapers in the longitudinal direction at a part 16 of approximately 1000 μm connecting to the optical fiber 20 as shown in FIG. 2(B). The tapered part 16 keeps a constant core depth thickness as shown in FIG. 2(A). The tip width of the core

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contd.
12 is 0.5 μm for example. Such a tapered form of the core 12 can be easily obtained using a photolithograph method when the core 12 is formed on a quartz substrate.

Please amend the paragraph from Page 11, line 4, to Page 12, line 3, to read as follows:

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In the core 12 which width and depth are constant, light propagates in a single mode with a mode field diameter of approximately 5 μm . In the tapered part 16, since the width of the core 12 gradually narrows, the light also gradually converts to a radiation mode. Because the length of the taper part 16 is sufficient long as 1000 μm , the conversion from the fundamental guided mode to the radiation mode is adiabatically performed, and the loss due to the mode conversion becomes extremely low. The radiation mode is not shut in the core 12 and accordingly its MFD gradually increases. As shown in FIG. 3, although field patterns of the propagation light indicate slight differences between the width and thickness directions, both keep the forms that roughly approximate a Gaussian distribution. At the tip of the tapered part 16, the average value of the MFD in the width and thickness directions becomes approximately 9.0 μm , which is close to the MFD (approximately 9.5 μm) of the optical fiber 20. The shape of the tapered part 16 is symmetrical relative to an optical axis. Therefore, the propagating direction of the radiation mode equals that of the guided mode, and the propagating direction of the light does not change even after almost all the light is shifted to the radiation mode. Such are the reasons why the coupling loss decreases when the tip width of the core 12 is extremely narrowed as shown in FIG. 4.

In the Abstract of the Disclosure

Please replace the Abstract of the Disclosure with an amended Abstract of the Disclosure enclosed herewith on a separate page.

In the Claims

Please amend Claims 1, 2, 3, 6 and 7 to read as follows. Claims 4, 5 and 8 are unchanged by the present amendment but are included herewith for the Examiner's reference convenience.